

SECTION 16920

MOTOR CONTROL CENTERS AND MOTOR STARTERS

PART 1 - GENERAL

0.1 DESCRIPTION OF WORK

A. Work Included:

This Section specifies furnishing and installing motor control centers and individually mounted ac motor starters.

0.2 SUBMITTALS

A. Shop Drawings: Submit drawing for motor control centers in accordance with NEMA Standards ICS for Class II, Type C construction.

B. Accessories and Spare Parts

1. Accessories. Provide special tools or other devices normally furnished or required for installation, care and maintenance of equipment.
2. Spare Parts. Furnish following items in containers suitable for storage:
 - a. One spare circuit breaker for each 10 or less circuit breakers of given type, frame size, and trip rating.
 - b. One spare contactor (motor starter) for each 10 or less contactors (motor starters) of given size.
 - c. One set of spare overload heater elements for each 10 sets of specific size.
 - d. 10 percent spare fuses for both primary and secondary's of control power transformers.
 - e. 100 percent replacement of indicating lamps.
 - f. 50 percent replacement of indicating lamp lenses.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Protection. Protect work, equipment, and materials from dirt, water, chemical, or mechanical damage.

1.4 QUALITY ASSURANCE

- A. Must meet requirements of all regulatory agencies.

PART 2 - PRODUCTS

0.1 GENERAL

- A. Construct products of the same type, size, rating, and functional characteristics, to be interchangeable.
- B. Enclosures. Select motor controller and switch enclosures suitable for the environment in which they are to be used as follows:
 - 1. Enclosures for use indoors and in dry, dust free areas: NEMA Type 1.
 - 2. Enclosures for outdoor locations or where moisture is present: Stainless steel NEMA type 3R, Type 4, or Type 4X, weatherproof enclosure, as indicated.
 - 3. Enclosures for areas where dust and dirt are likely to be present: NEMA 12 industrial type.
 - 4. Factory Finish. Degrease and provide phosphate coating, after fabrication, to surfaces which are to be painted. Apply undercoat of rust resistant paint such as zinc chromate over the phosphate coating (except for stainless steel). Apply finish painting of baked on, ANSI 61 gray enamel.

0.2 BUS SYSTEM

- A. General
 - 1. Provide silver plated copper bus bars.
 - 2. Provide continuous horizontal busing for full length of unit or shipping section. Provide splice buses (100 inches maximum and less if required by building structural conditions) to connect shipping sections in the field.
 - 3. Bus connections
 - a. Provide connections that are completely serviceable from the front.
 - b. Provide constant pressure reliable joints by making connections by use of bolts, flat steel washers and conical spring washers.
 - c. Provide carriage type bolts or self clinching nuts to allow for joint maintenance using one wrench from the front only.
 - 4. Provide buses rated at minimum ampere rating to match main breaker, size and braced for 42,000 rms symmetrical amperes.
- B. Bus Supports
 - 1. Provide supports contoured with vertical surfaces to minimize dirt buildup.
 - 2. Provide supports which utilize high quality, track resistant, flame retardant, void free, crack resistant fiberglass filled polyester.
 - 3. Provide supports colored red to warn of proximity to energized buses.

C. Bus Ratings

1. Horizontal Buses. Provide buses rated as specified, but not less than 600 amperes.
2. Vertical Buses. Provide buses rated as specified, but not less than 300 amperes.
3. Neutral Buses. Provide buses ram at control centers amperes.
4. Power Buses. Provide buses large enough to accommodate loads fed from that bus.

D. Bus Isolation

1. Provide horizontal and vertical buses protected on all sides against accidental contact.
2. Provide isolation by means of steel partition constructed as integral part of basic structure and not subject to removal or improper replacement.
3. Do not use sheet metal fasteners within bus zones.
4. Provide receptacles for plug in connections to vertical buses capable of preventing accidental contact when buses are not in use.
5. Provide bus isolation parts colored red to indicate proximity to energized buses.
6. Provide bottom bus covers below vertical buses to protect ends from accidental contact with fish tapes entering from the bottom.

E. Arrangement

1. Provide horizontal and vertical bus systems on front to rear center of structure to permit economical use with both front and rear mounted units.
2. Provide phase sequence A B C top to bottom, front to back, and left to right when viewed from bottom of enclosures.

F. Grounding. Provide each motor control center equipped with silver plated copper ground bus, rated at 300 amperes, and extending entire length of assembly. Mount ground bus in bottom horizontal wireway.

0.3 CONTROL UNITS

A. Type. Provide molded case circuit breaker combination starter type

B. Circuit Breakers

1. Provide circuit breaker combination starters with three pole magnetic only motor circuit protectors specifically designed for motor circuit protection in accordance with NEC.
2. Provide branch feeder circuit breakers of three pole thermal magnetic molded case type with frame size and trip ratings as specified, and having minimum interrupting capacity of 25,000 amperes rms symmetrical or higher required.

C. Mounting

1. Provide units mounted on unit support pan or in bucket type housing.
2. Provide units of either tilt and lift-out or drawout type utilizing rails in order that rearrangement of relocation of individual units can be readily accomplished.

D. Plug-on Units

1. Saddles
 - a. Provide each plug-on unit with sheet steel saddle designed to physically isolate unit from bus compartment and adjacent units.
 - b. Provide saddles equipped with captive, self-aligning mounting screws, capable of holding units in place during shipment and maintaining units and structure at that potential.
 - c. For added safety during installation and maintenance provide saddles equipped with provision to permit them to be padlocked in the section in a position so that contact fingers are disengaged from bus bars.
 - d. Provide each unit having hand holds to facilitate unit removal.

E. Plug-on clips

1. Provide silver-plated clips designed to increase contact pressure under load or short circuit conditions.
2. Assure positive alignment of bus bar and clips by design of unit mounting plan, clips, and vertical bus bar.

F. Plug-on Contacts. Provide contacts on following units:

1. Full voltage starters NEMA size 4 and smaller.
2. Branch circuit breaker units 225 ampere frame and smaller.

G. Manual Motor Starters

1. Provide quick-make, quick-break, toggle switch type, with thermal alloy type overload protection. Use manual motor starters for single-phase motors rated less than 1/2 horsepower.
2. Toggle Switch Operator: Provide operator guarded and equipped with a red indicating light to show when the switch is in the closed position.

H. Magnetic Motor Starters

1. Provide full voltage, across-the-line reversing or non-reversing type as required rated for design load requirements, sized to conform with standard NEMA ratings for given horsepower, except minimum size shall be NEMA size 1, and designed for use on nominal 480 volt, three phase, 60 Hertz service unless specified otherwise in the Construction Specifications; with 120 volt control circuits; minimum three thermal type ambient compensated as indicated, manual reset, overload relays

for motor protection; tow convertible auxiliary contacts with provision for field mounting of minimum two future auxiliary contacts; red, green, and amber indicated, and hands-off-automatic switch where automatically controlled, as indicated. Additionally, provide indicating lights, push-button, and selector switches with legend plates.

2. Provide overload relays selected, and sized, based on actual full load amperes of particular motor. Additionally, heaters shall be applied in conformity with NEC and manufacturer's recommendations.
 3. Provide fuse control transformers for magnetic starters in the primary circuit.
- I. Reversing Starters. Provide these starters as indicated, equipped with minimum three overloads. Additionally, starters shall be electrically and mechanically interlocked.
- J. Reduced Voltage Starters. 480 volt 2 step, 3 leg or 2 leg closed transition, auto transformer type with taps for 50, 65, and 80 percent of line voltage, each complete with:
1. One control transformer rated 480/120 volts;
 2. One pneumatic adjustable timer;
 3. Three thermal overload relays suitable for the applicable motor;
 4. One thermal switch for protection of each auto transformer;
 5. Control devices as indicated mounted in the door of the motor starter;
 6. One set of miscellaneous auxiliary contacts as required by the Contract Drawings; and
 7. One molded case circuit breaker or motor circuit protection with the appropriate interrupting capacity.
- K. Two-speed motor starters. Provide smooth control centers speed, single or two winding, constant motors, as indicated, with automatic sequence accelerating relay which will always start motor on low speed first.
- L. Doors
1. Starter and Feeder Units
 - a. Securely mounted with heavy-duty hinges which allow doors to swing open minimum 112 degrees for each of unit maintenance.
 - b. Fastened to stationary structure designed so that they can be closed to cover unit space when unit has been temporarily removed.
- M. Held closed with captive type knurled or screw driver operable screws designed to hold doors closed under fault conditions and to discourage unauthorized opening of doors.
1. Combination Motor Starter Units. Provide units having doors with overload reset button, oil tight pilot lights and push button stations or selector switches as required and as specified in the Construction

Specifications; and spare contacts, four each normally open and normally closed.

N. Circuit Breaker Handles

1. Provide units having integral circuit breaker handle, color coded to indicate "ON", OFF" or TRIPPED" position.
2. Provide operation handles interlocked with units' doors, such that circuit breaker cannot be switched to "ON" position unless unit door is closed. It shall be possible for qualified or authorized personnel to defeat aforementioned interlocked should it be necessary to observe operation of operating handle. Additionally, interlock shall prevent opening unit door unless circuit breaker is in "OFF" position.
3. Provide units having defector, which shall permit qualified or authorized personnel to gain access to units without interrupting service.
4. Provide unit door operating handle capable of being locked in "ON" or "OFF" position with minimum of three padlocks.

O. Control Unit Assembly

1. Assembled units with control leads for starters and motors for NEMA size 4 combinations and smaller to fully shielded terminal boards with disconnecting type terminal blocks within unit cell.
2. Provide units with minimum 20 terminals.
3. Load terminals for branch circuit breakers are not required.

0.4 AUXILIARY DEVICES

A. Control Transformers

1. Provide each combination motor starter unit with transformer sized to handle starter coil burden plus minimum two pilot lights. Additionally, provide each transformer sized to carry minimum 100 VA more capacity than required.
2. Provide transformers having two dual element primary fuses sized at approximately 125 amperes. Additionally, provide single secondary dual element fuse sized to protect against transformer overload. Provide transformers with coil side of transformer secondary grounded to unit support or back pan.

0.5 UNIT SPACE HEATERS

- A. Provide heaters of required rating for each vertical section of motor control centers. Additionally, heaters shall be suitably located so that components in same vertical section are uniformly heated.
- B. Provide space heater bus having 120 volt, 60 Hertz, supply from step down transformers fed from motor control center buses.

- C. Do not load each space heater circuit more than 10 amperes, and additionally provide each circuit with one set of fused disconnect, adjustable thermostat and by pass switch in common.

0.6 FABRICATION

A. Structures

1. Provide structures constructed in one, two or more vertical assemblies. Ship motor control centers as completely assembled as possible. Shipping sections may be used but control centers shall be completely assembled and tested as unit at factory before being broken into shipping sections. Provide splice buses, bolts, nuts, flat washers and conical spring washers if used as required for complete assembly bagged and shipped with sections for field assembly.
2. Provide each shipping section with removable lifting eyes or angles for lifting and handling; and shipping skid to permit handling shipping sections with forklifts.
3. In base channels of each vertical center minimum of two boltholes designs of anchor bolts in securing assembly to floor.
4. Removable Plates Requirement
 - a. Provide sections with removable end closing plates to facilitate addition of future sections.
 - b. Provide indoor units with one piece construction, removable top plates to facilitate cutting of conduit holes.
 - c. Cover unused unit spaces with removable blank plates flanged on four sides and having captive screws.

B. Wireways

1. Horizontal Wireway Requirements
 - a. Provide as horizontal wireway space, total of 18 inches structure height.
 - b. Provide 12-inch high wireway at point of cable entry across either top or bottom of Structure.
 - c. Provide access to horizontal wireways by removable front cover plates flanged on four sides, and secured with captive screws.
2. Vertical Sections
 - a. Provide each vertical section with full heights unobstructed vertical wireway, having cross section of not less than 19 inches square, under separate door secured with captive screws.
 - b. Complete isolate vertical wireway from busing and insofar as practical from control units.
 - c. Provide wire ties as required to secure wiring in vertical wireways.
3. Wire Passage Ways
 - a. Provide wire passageways from front horizontal wireways.
 - b. Provide wireways as specified, having no structural interferences within minimum of 10 inches of floor, or top if top fed.

4. Control Units. When control units are specified for front mounting only, provide structure having rear space accessible from front for conduit or cable entry and wire routing. Additionally, it shall be possible to route cables forward and through full height of vertical wires.

PART 3 - EXECUTION

0.1 INSTALLATION

- A. Assemble motor control centers, including installation and taping of buses, in accordance with manufacturer's written recommendation and instructions.
- B. Install motor control centers as indicated in accordance with applicable local codes and conforming to the Massachusetts Electrical Code.
- C. Make electrical connections.
- D. After motor control centers have been leveled on the foundation, place non-shrink construction grout between cabinet bases and the foundation.

PART 4 - MEASUREMENT AND PAYMENT

0.1 MEASUREMENT

- A. Motor control centers will be measured as per each complete in place, including all preparation, accessories and incidentals.

0.2 PAYMENT

- A. Payment for motor control centers will be made at the Contract unit price for the quantities as specified above.

0.3 PAYMENT ITEMS

ITEM NO.	DESCRIPTION	UNIT
1671.003	MOTOR CONTROL CENTERS	EA

END OF SECTION